INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2005/003156

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L25/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data, INSPEC, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KALEONG LO ET AL: "Layered space time coding with joint iterative detection, channel estimation and decoding" SPREAD SPECTRUM TECHNIQUES AND APPLICATIONS, 2002 IEEE SEVENTH INTERNATIONAL SYMPOSIUM ON SEPT. 2-5, 2002, PISCATAWAY, NJ, USA,IEEE, vol. 2, 2 September 2002 (2002-09-02), pages 308-312, XP010615481 ISBN: 0-7803-7627-7 page 308, right-hand column - page 309, left-hand column, Section II. page 310, left-hand column, Section IV. - page 311, right-hand column, first paragraph figures 1-3	1-3,12, 15-19, 26-28, 30,31
Y		8

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 September 2005	06. 10. 2005

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
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Fax: (+31-70) 340-3016

Authorized officer
Baltersee, J

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 211 819 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 5 June 2002 (2002-06-05) paragraph '0015! - paragraph '0033! figures 3,5,8	1,2,12, 15-18, 27,30
X	WO 97/44916 A (NOKIA TELECOMMUNICATIONS OY; PIIRAINEN, OLLI) 27 November 1997 (1997-11-27) page 4, line 21 - page 6, line 31	1,2,12, 15-18, 27,30
A	PAULRAJ A ET AL: "Introduction to Space-Time Wireless Communications" May 2003 (2003-05), CAMBRIDGE UNIVERSITY PRESS , CAMBRIDGE, U.K. , XP002333354 ISBN: 0 521 82615 2 page 178 - page 184	1-3,12, 15-19, 26-28, 30,31
X	ZEMEN T ET AL: "Iterative detection and channel estimation for MC-CDMA" ICC 2003. 2003 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS. ANCHORAGE, AK, MAY 11 - 15, 2003, IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS, NEW YORK, NY : IEEE, US, vol. VOL. 1 OF 5, 11 May 2003 (2003-05-11), pages 3462-3466, XP010643089 ISBN: 0-7803-7802-4 page 3462, left-hand column, Section "I. Introduction", lines 1-6 page 3463, right-hand column, Section "III. Data Detection" - page 3464, left-hand column, Section "IV. Decoding" page 3464, right-hand column, Section "V. Channel Estimation" - page 3465, right-hand column, Section "VI. Simulation Results", line 5 figures 1,2	1,3-7, 13,14, 27,29, 30,32-34
Y	RALEIGH G G ET AL: "MULTIVARIATE MODULATION AND CODING FOR WIRELESS COMMUNICATION" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 17, no. 5, May 1999 (1999-05), pages 851-866, XP000830239 ISSN: 0733-8716 page 860, right-hand column, step 1) - page 861, left-hand column, step 4)	8

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JIE ZHU ET AL: "Channel estimation with power-controlled pilot symbols and decision-directed reference symbols 'OFDM systems!" VEHICULAR TECHNOLOGY CONFERENCE, 2003. VTC 2003-FALL. 2003 IEEE 58TH ORLANDO, FL, USA 6-9 OCT. 2003, PISCATAWAY, NJ, USA,IEEE, US, 6 October 2003 (2003-10-06), pages 1268-1272Vol2, XP010700808 ISBN: 0-7803-7954-3 page 1269, left-hand column, Section "II. System Model", up to the first line after equation (2) page 1269, right-hand column, line 4 - page 1279, left-hand column, up to Section "III. B. Power Controlled Pilots" figure 1	1,9-11, 20-24, 27,30,33
X	COLERI S ET AL: "Channel Estimation Techniques Based on Pilot Arrangement in OFDM Systems" IEEE TRANSACTIONS ON BROADCASTING, vol. 48, no. 3, September 2002 (2002-09), pages 223-229, XP002344335 page 223, left-hand column page 223, right-hand column, Section "II. System Description" - page 225, left-hand column, Section "IV. Channel Estimation at ..." figure 1	25
A	MEYR H ET AL: "Digital Communication Receivers: Synchronization, Channel Estimation, and Signal Processing" 1998, WILEY-INTERSCIENCE , NEW YORK, U.S.A , XP002344337 page 649 - page 650	25

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INTERNATIONAL SEARCH REPORT

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-4, 12, 15-19, 26-28, 30, 31

   Joint detection and estimation of two superposed data streams

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2. claims: 5-7

   Enabling further processing or refinement of a frequency domain channel estimate in the time-domain

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3. claim: 8

   Enabling further processing or refinement of a time-domain channel estimate in the frequency domain

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4. claims: 9-11

   Iterative channel estimation in a multicarrier communication system

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5. claims: 13-14, 29, 32-34

   Iterative channel estimation based on remodulated symbols

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6. claims: 20-22

   Refinement of frequency-domain channel estimates

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7. claims: 23-25

   Pilot-based channel estimation in an multicarrier communication sytem

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2005/003156

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			AU	7578801 A	05-02-2002
			EP	1211819 A1	05-06-2002
			CN	1386334 A ,C	18-12-2002
			WO	0209317 A1	31-01-2002
			US	2002164967 A1	07-11-2002
WO 9744916	A	27-11-1997	FI	962140 A	22-11-1997
			AT	262241 T	15-04-2004
			AU	722245 B2	27-07-2000
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			CN	1216647 A	12-05-1999
			DE	69728143 D1	22-04-2004
			EP	0894365 A1	03-02-1999
			WO	9744916 A1	27-11-1997
			JP	2000511012 T	22-08-2000
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